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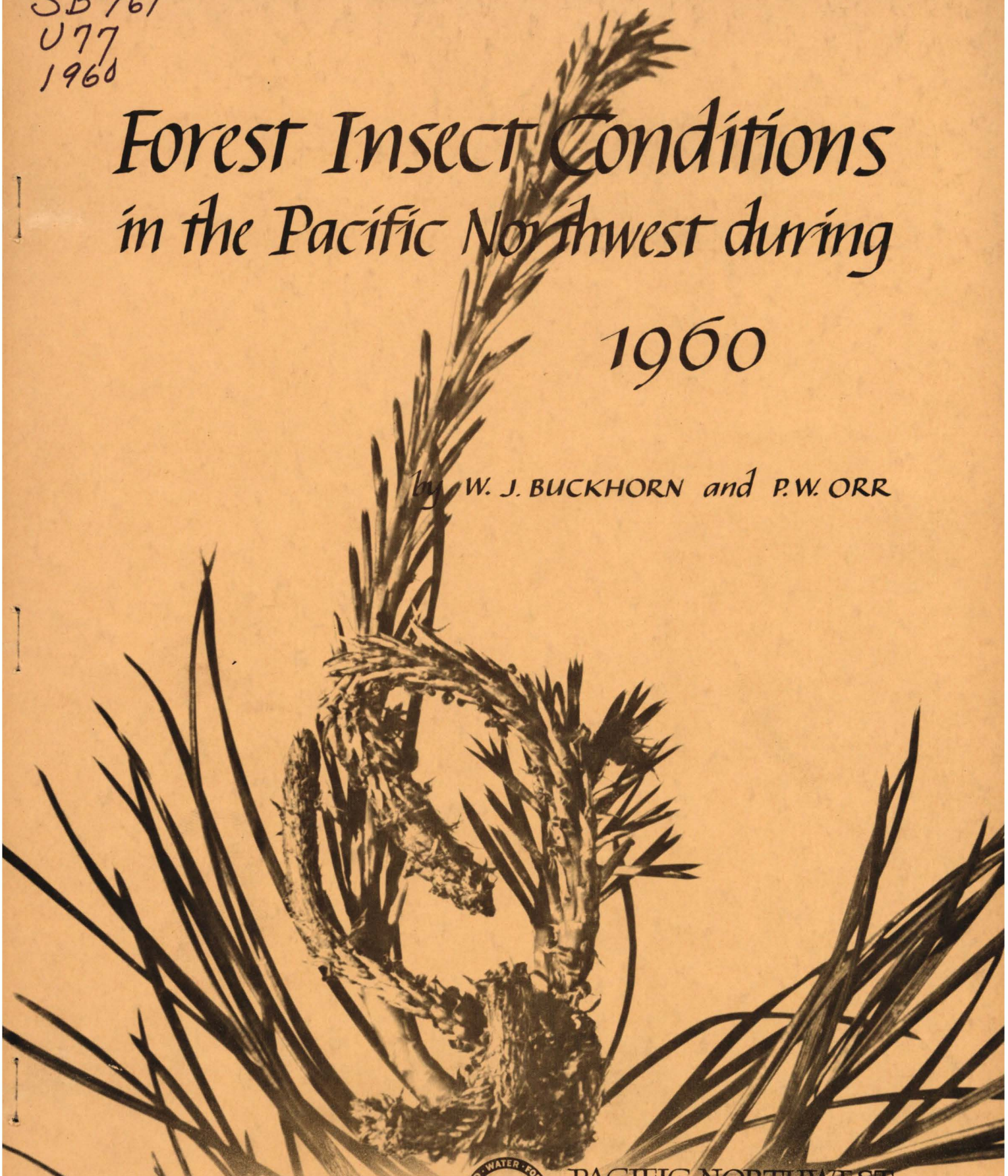
Forest Insect Conditions in the Pacific Northwest during 1960

by W. J. BUCKHORN and P. W. ORR



PACIFIC NORTHWEST
FOREST AND RANGE EXPERIMENT STATION
U.S. DEPT. OF AGRICULTURE · FOREST SERVICE
SEPTEMBER 1961

This is the 13th annual report on forest insect conditions in Oregon and Washington, based on cooperative surveys sponsored by the Northwest Forest Pest Action Council. The combined efforts of many organizations and individuals made these surveys possible. Special acknowledgment is made to the principal cooperators. Oregon State Board of Forestry, Washington State Department of Natural Resources, and Weyerhaeuser Company.

COVER BACKGROUND: Scotch pine leader showing damage caused by the European pine shoot moth, Rhyacionia buoliana (Schiff.).

FOREST INSECT CONDITIONS IN THE PACIFIC NORTHWEST DURING 1960

By

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and

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September 1961

PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION

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FOREST SERVICE — U.S. DEPARTMENT OF AGRICULTURE

We ask that you take special notice that the attached report describes forest insect conditions for 1960. We are sorry to be so late in issuing the report.

In the future, reports in this series will be issued by the Insect and Disease Surveys and Control Unit of the Division of Timber Management, Region 6, U. S. Forest Service.

The results of surveys of 1961 conditions are now being evaluated and summarized; a copy will be sent to you early in January 1962.

C O N T E N T S

	Page
SURVEY FINDINGS IN BRIEF	1
INTRODUCTION	3
DEFOLIATORS	3
Spruce Budworm	3
European Pine Shoot Moth	5
Ponderosa Pine Needle Miner	5
Larch Bud Moth	5
Black-Headed Budworm	6
Western Oak Looper	6
Sawflies	6
Larch Casebearer	7
Lodgepole Pine Needle Miners	7
Pine Budworm	7
SUCKING INSECTS	7
Balsam Woolly Aphid	7
Pine Needle Scale	9
BARK BEETLES	9
Mountain Pine Beetle	9
Douglas-Fir Beetle	14
Western Pine Beetle	17
Oregon Pine Ips	18
Fir Engraver	18
Engelmann Spruce Beetle	19
Silver Fir Beetles	20
SEED AND CONE INSECTS	20
NURSERY AND REGENERATION INSECTS	21
Ten-Lined June Beetle	21
Pine Resin Midge	21
Sitka-Spruce Weevil	21

Page

OTHER FOREST PROBLEMS 21

Dying Hemlock 21
Bear Damage 22

APPENDIX 23

Organization and Conduct of Aerial Surveys 23
Table 17. Extent of epidemic infestations in Oregon in 1960, by forest area, insect species, and intensity of infestation 24
Table 18. Extent of epidemic infestations in Washington in 1960, by forest area, insect species, and intensity of infestation 33
Figure 1. Generalized areas of forest insect epidemics in Oregon and Washington, 1960 . . . . . .

SURVEY FINDINGS IN BRIEF

Epidemic outbreaks in the Pacific Northwest totaled 1,272,960 acres this year (table 1). It is the lowest total for the 10 years for which records are complete. The extent and intensity of outbreaks by insect species are given in the appendix in Table 17 for Oregon and in Table 18 for Washington. Locations of the most extensive outbreaks are shown in figure 1 in the appendix.

Principal findings of the 1960 survey were:

1. The trend of spruce budworm infestation continued downward on all areas except on the Yakima Indian Reservation and adjacent private lands in southern Washington, where it was static or slightly upward.

2. Outbreaks of the mountain pine beetle increased in extent and severity in western white pine stands along the Cascade Range in southern Washington. Losses increased moderately in both lodgepole pine and ponderosa pine pole stands in Oregon.

3. The Douglas-fir beetle outbreak in southern Oregon largely subsided, but in northern Washington the epidemic increased in extent and intensity. New centers of damage developed in the Blue Mountains region of Oregon and Washington, and in north-central Washington.

4. Western pine beetle outbreaks in Washington, especially on the Yakima Indian Reservation, have largely subsided. In Oregon the trend of infestation continued upward, with losses reaching epidemic proportions in many areas.

5. Oregon pine ips populations increased especially in the Blue Mountains region of Oregon.

6. Fir engraver damage was widespread but not serious.

7. Balsam woolly aphid infestation in Pacific silver fir stands declined to the lowest level recorded since the outbreak was discovered in 1954; but heavy killing has been renewed in subalpine fir stands on the Willamette National Forest.

8. An unknown Olethreutid, probably Zeiraphera sp., lightly defoliated extensive areas of Pacific silver fir along the west slope of the Cascade Range in Washington.

Chemical control was limited to small projects against bark beetles in Crater Lake National Park and on the Fremont National Forest. Sanitation-salvage logging to control the western pine beetle was increased on many forests. Prompt salvage of pine damaged or killed on the 1959 burns prevented serious epidemics of the western pine beetle from developing in this material, then emerging, attacking, and killing the adjacent green stand. The importation of foreign insect predators to control the balsam woolly aphid was continued for the fourth successive year but on a reduced scale.

Table 1.--Summary of 1960 forest insect epidemic infestations in Oregon and Washington

Insects [1]	Oregon		Washington		Regional Total	
	Infestation centers	Area	Infestation centers	Area	Infestation centers	Area
	Number	Acres	Number	Acres	Number	Acres
Defoliators:						
Spruce budworm	42	264,560	3	20,960	45	285,520
Zeiraphera sp.	0	0	15	75,680	15	75,680
Ponderosa pine needle miner	8	52,560	0	0	8	52,560
Larch sawfly	0	0	4	5,440	4	5,440
Larch bud moth	0	0	2	2,080	2	2,080
Western oak looper	1	2,080	0	0	1	2,080
Larch casebearer	0	0	1	1,920	1	1,920
Lodgepole needle miner	0	0	1	1,120	1	1,120
Black-headed budworm	1	440	0	0	1	440
Pine budworm	0	0	1	320	1	320
All defoliators	52	319,640	27	107,520	79	427,160
Sucking insects:						
Balsam woolly aphid	43	66,440	4	760	47	67,200
Pine needle scale	1	320	0	0	1	320
All sucking insects	44	66,760	4	760	48	67,520
Bark beetles:						
Mountain pine beetle (W)	91	31,040	338	209,400	429	240,440
Mountain pine beetle (L)	68	40,080	25	6,440	93	46,520
Mountain pine beetle (P)	55	14,520	26	4,740	81	19,260
Mountain pine beetle (S)	4	480	0	0	4	480
Douglas-fir beetle	508	114,160	243	104,440	751	218,600
Western pine beetle	289	142,520	29	18,940	318	161,460
Oregon pine ips	249	38,160	28	3,360	277	41,520
Fir engraver	90	27,240	50	14,680	140	41,920
Engelmann spruce beetle	5	1,840	8	3,120	13	4,960
Silver fir beetle	0	0	7	3,120	7	3,120
All bark beetles	1,359	410,040	754	368,240	2,113	778,280
All insects	1,455	796,440	785	476,520	2,240	1,272,960

[1] Mountain pine beetle infestations are separated by tree species: L, lodgepole pine; P, ponderosa pine; S, sugar pine; W, western white pine.

INTRODUCTION

Survey procedures were the same as in recent years. Epidemic infestations were detected, evaluated, and mapped as to intensity from the air by standard methods.[1/] Ground surveys varied from an intensive and time-consuming evaluation of the spruce budworm egg populations to general checking to verify the accuracy of aerial mapping.

DEFOLIATORS

SPRUCE BUDWORM
Choristoneura fumiferana (Clem.)

Epidemic outbreaks of the spruce budworm were recorded in the Pacific Northwest for the 17th consecutive year. The extent of the infestations increased slightly since 1959 but the intensity changed little, continuing generally light to moderate (table 2). On small areas in the Warner Mountains on the Fremont National Forest in southern Oregon, current defoliation was heavy and some bud killing had occurred, but no immediate tree killing was in prospect. In Northeastern Oregon, in the Wallowa-Whitman National Forests, defoliation was relatively light and little or no bud killing had taken place. In southern Washington, on and near the Yakima Indian Reservation, defoliation was generally light with spots of moderate intensity.

A comparison of the recorded epidemic infestations during 1959 and 1960 is as follows:

Administrative Unit	1959		1960	
	Acres	Percent	Acres	Percent
Oregon:				
Wallowa-Whitman Natl. Forest	115,480	55	48,800	17
Fremont Natl. Forest	82,400	40	215,760	76
Washington:				
Yakima Indian Reserv.	4,800	2	6,720	2
Glenwood Dist.	5,160	3	14,240	5
Totals	207,840	100	285,520	100

[1/] Wear, J. F., and Buckhorn, W. J. Organization and conduct of forest insect aerial surveys in Oregon and Washington. U.S. Forest Serv. Pac. NW. Forest and Range Expt. Sta., 40 pp., illus. 1955. (Processed.)

A biological evaluation survey of the 1960-61 budworm population indicated a continued downward trend in northeastern Oregon.[2/] In southern Washington the light epidemic outbreak was found to be static or increasing slightly. Natural controls are becoming increasingly more effective on most areas, hence no spraying is planned in 1960.

Table 2.--Extent of spruce budworm infestations in Oregon and Washington in 1959, by control unit and intensity of infestation

(In acres)

Administrative area and control unit	Intensity of infestation: Light	Moderate	Heavy	All intensities
Oregon:				
Fremont Natl. Forest				
Warner Mt.	52,560	20,160	5,920	78,640
Gearhart Mt.	100,480	36,640	0	137,120
Total	153,040	56,800	5,920	215,760
Wallowa-Whitman Natl. Forest				
Pine Cr.	12,000	480	0	12,480
Snake	36,320	0	0	36,320
Total	48,320	480	0	48,800
Washington:				
Yakima Indian Reserv.				
Simcoe Butte	5,760	960	0	6,720
Glenwood Dist. (Washington State Dept. Natural Resources)				
Simcoe Butte	12,000	2,240	0	14,240
All units	219,120	60,480	5,920	285,520

[2/] Orr, P. W. Evaluation of 1960-61 spruce budworm populations in Oregon and Washington. U.S. Forest Serv. Pac. NW. Forest and Range Expt. Sta. 4 pp. Oct. 24, 1960. (Processed.)

EUROPEAN PINE SHOOT MOTH
Rhyacionia buoliana (Schiff.)

An intensive cooperative survey of ornamental nurseries, sales yards, and plantings was made to determine the distribution of this introduced pest of pines. So far it has been found at one nursery in Portland, Oreg., and one nursery and planting in Spokane and at many nurseries, sales outlets, and ornamental plantings in the Puget Sound area of Washington. All of the infested pines in the Portland nursery have been destroyed and those at Spokane will be destroyed next spring.

Fumigation with methyl bromide is being tested in the Puget Sound area to devise efficient techniques, concentrations of fumigants, and exposure times to obtain 100-percent mortality. Pending the outcome of these tests, eradication by fumigation may be carried out on all infested areas to prevent this serious pest of pine from becoming established in the ponderosa pine region.

PONDEROSA PINE NEEDLE MINER
Argyresthia sp.

The outbreak that developed on the Warner Ranger District of the Fremont National Forest during 1958 continued to increase in extent and severity. While no tree killing by this insect is anticipated, the trees may be weakened to the extent that they will become attractive to the western pine beetle and other bark beetles.

Studies are continuing on the life history of this insect to determine the stage when control measures would be most effective.

LARCH BUD MOTH
Zeiraphera griseana (Hübner)

The downward trend of infestation continued. Only two small centers remain of the extensive outbreaks during 1958 in larch stands along Washington's Cascade Range. This trend is characteristic; the outbreaks flare up then decline in a year or so without causing material damage to the stands.

BLACK-HEADED BUDWORM
Acleris variana (Fern.)

An epidemic of the black-headed budworm developed in conjunction with an outbreak of spruce budworm on and adjacent to the Yakima Indian Reservation during 1959. The black-headed budworm population subsided but the spruce budworm infestation continued unabated.

A small outbreak developed on mountain hemlock, western hemlock, grand fir, and Douglas-fir on the Mount Hood National Forest, but caused only light defoliation. The past history of black-headed budworm outbreaks in Oregon and Washington has been that they flare up quickly and then subside rapidly without causing extensive damage.

WESTERN OAK LOOPER
Lambdina fiscellaria somniaria (Hulst)

A severe epidemic developed west of Monmouth, Oreg. Oaks were stripped of foliage early in the summer, and intermingled species were heavily fed upon. By late August some of the affected trees had put out a partial crop of leaves. The history of these outbreaks has been that while they are spectacular, they usually subside after a year or so without causing permanent damage.

SAWFLIES
Neodiprion spp.

The outbreak of an unidentified species of sawfly, reported last year on Douglas-fir near Puyallup, Wash., subsided, but other outbreaks were recorded on lodgepole pine and western larch.

Lodgepole pine.--A light infestation appeared near Tumwater, Wash. Outbreaks of this insect have frequently appeared on lodgepole pine in the Puget Sound area and along the coast, but they soon subsided without causing material damage to the stand.

Western larch.--Epidemics developed on and adjacent to Mount Spokane in northeastern Washington. Defoliation ranged from light to moderate. While this insect has been known to cause considerable damage to larch stands, the usual trend is to flare up then subside after a year or so without causing extensive damage.

LARCH CASEBEARER
Coleophora laricella (Hübner)

A light epidemic outbreak near Mica Peak, east of Spokane, Wash., marks the first time this European insect has been reported in Washington. It was first reported in Massachusetts in the 1880's and has since spread westward and become established throughout most of the range of the larches. Although 18 to 20 species of native insect parasites attack the casebearer in the northeastern States, none have ever been abundant enough to bring about any appreciable degree of control. Artificial control is very difficult under forest conditions.

LODGEPOLE PINE NEEDLE MINERS

Three species of needle miners caused light-to-moderate defoliation in lodgepole pine stands in the vicinity of Olympia, Wash., this year. None of the insects involved have been identified yet. Similar outbreaks in the past have subsided from natural causes without causing appreciable damage to the stand. Hence, control measures are unnecessary.

PINE BUDWORM
Archips retiniana Wlsm.

A small area of ponderosa pine saplings east of Leavenworth, Wash., were lightly attacked this year. The trees attacked by this insect are seldom killed outright, but repeated destruction of the buds deforms a tree to a bushy shrub. Once the attacks cease, the trees generally recover.

SUCKING INSECTS

BALSAM WOOLLY APHID
Chermes piceae (Ratz.)

Epidemic infestations of the balsam woolly aphid declined markedly in the Pacific silver fir stands in Oregon and Washington (table 3). Aphid populations in subalpine fir stands along the Cascade Range in both States continued to increase, indicating that extensive tree killing is likely to resume soon. The bulk of this year's mortality occurred on the Willamette National Forest in Oregon (table 4).

Efforts to effect biological control by colonizing foreign insect predators were continued on a reduced scale.

Table 3.--Trend of balsam woolly aphid infestation in Oregon and Washington, 1957-60

(In acres)

Year of detection	Area of epidemic infestation: Oregon	Washington	Regional total
1957	385,200	214,560	599,760
1958	110,560	145,760	256,320
1959	50,880	108,480	159,360
1960	66,440	760	67,200

Table 4.--Extent of balsam woolly aphid infestations in Oregon and Washington in 1960, by administrative area and intensity of infestation

Administrative area	Infestation centers	Intensity of infestation: Light	Moderate	Heavy	All intensities
	--Number--		-------Acres-------		
Oregon:					
Deschutes Natl. Forest	2	1,280	0	0	1,280
Mt. Hood Natl. Forest	2	2,640	0	0	2,640
Siuslaw Natl. Forest	1	280	0	0	280
Umpqua Natl. Forest	4	320	800	320	1,440
Willamette Natl. Forest	34	48,320	7,040	5,440	60,800
Oregon areas	43	52,840	7,840	5,760	66,440
Washington:					
Gifford Pinchot Natl. Forest	2	640	0	0	640
Snoqualmie Natl. Forest	1	40	0	0	40
Yakima Indian Reserv.	1	0	80	0	80
Washington areas	4	680	80	0	760
All areas	47	53,520	7,920	5,760	67,200

PINE NEEDLE SCALE

Phenacaspis pinifoliae (Fitch)

Recent epidemic outbreaks of the pine needle scale have largely subsided. Only one small infestation, in the Hood River Valley, Oregon, was of sufficient intensity to be mapped. Elsewhere in the region, subepidemic populations were fairly common on various pine species in different areas. So far, the pine needle scale has not caused enough damage to warrant control measures on forest areas.

BARK BEETLES

MOUNTAIN PINE BEETLE

Dendroctonus monticolae Hopk.

Epidemic outbreaks increased in total area in 1960 (table 5). The situation varied by tree species as follows:

Western white pine.--Infested acreage in this species decreased on many areas in Oregon, but tree mortality was most prevalent on the Mount Hood and Willamette National Forests (table 6). Tree killing in Washington increased noticeably, particularly on the Gifford Pinchot, Wenatchee, Snoqualmie, and Okanogan National Forests and in Olympic National Park. At present, control of the mountain pine beetle in western white pine stands in this region is uneconomical because of the presence of blister rust.

Lodgepole pine.--Conditions varied considerably in 1960; increasing slightly in Oregon and decreasing somewhat in Washington (table 6). The largest and most aggressive outbreaks in Oregon were on the Fremont National Forest, Klamath Indian Reservation, and in Crater Lake National Park. The most concentrated losses in Washington were on the Colville National Forest. The outbreaks in Crater Lake National Park are being held in check by direct control and maintenance. Indications are that the upward trend in Oregon and the downward trend in Washington will continue next year.

Ponderosa pine.--Tree mortality in stagnated ponderosa pine pole stands increased sharply in Oregon but decreased in Washington (table 6). Losses in Oregon were heaviest on the Fremont, Wallowa-Whitman, and Deschutes National Forests. In Washington the damage was greatest on the Wenatchee and Gifford Pinchot National Forests. Mortality in these immature stands is likely to increase in the future if steps are not taken to relieve the stand competition which weakens the trees and makes them susceptible to beetle attack.

Ethylene dibromide was tested experimentally on infested trees on the Fremont National Forest in hopes it would serve as a stopgap measure until the stands could be thinned. Results of the Control experiment will be available soon.

Sugar pine.--Most of this year's losses occurred as single trees or small widely scattered groups. Tree-killing reached epidemic proportions at four centers on the Rogue River, Umpqua, and Deschutes National Forests (table 6).

Table 5.--Trend of mountain pine beetle infestations in Oregon and Washington, by host species, 1957-60 [1/]

(In acres)

Year of detection	Area of epidemic infestations							Regional total, all species
	Oregon				Washington			
	W	L	P	S	W	L	P	
1957	29,280	73,920	640	160	102,560	5,440	0	212,000
1958	32,160	36,640	2,560	0	190,880	5,920	0	268,160
1959	60,000	34,160	4,240	0	153,340	7,600	6,080	265,420
1960	31,040	40,080	14,520	480	209,400	6,440	4,740	306,700

[1/] Host species are: W, western white pine; L, lodgepole pine; P, ponderosa pine; S, sugar pine.

Table 6.--Extent of mountain pine beetle infestations during 1960 by administrative areas, host species, and intensity of infestation

Administrative area [1]	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
LODGEPOLE PINE						
Washington:						
Chelan Natl. Forest	4	960	0	0	0	960
Colville Indian Reserv.	1	480	0	0	0	480
Colville Natl. Forest	10	2,000	320	480	0	2,800
Kaniksu Natl. Forest	5	160	320	0	0	480
Spokane Indian Reserv.	1	120	0	0	0	120
Wenatchee Natl. Forest	3	480	640	0	0	1,120
Yakima Indian Reserv.	1	0	0	480	0	480
Washington areas	25	4,200	1,280	960	0	6,440
Oregon:						
Crater Lake Natl. Park	5	3,000	0	0	0	3,000
Deschutes Natl. Forest	12	3,040	480	0	0	3,520
Fremont Natl. Forest	22	10,040	6,400	1,440	2,240	20,120
Klamath Indian Reserv.	16	5,360	4,320	0	160	9,840
Malheur Natl. Forest	3	40	400	0	0	440
Rogue River Natl. Forest	8	2,080	480	320	0	2,880
Umatilla Natl. Forest	1	240	0	0	0	240
Wallowa-Whitman Natl. Forest	1	40	0	0	0	40
Oregon areas	68	23,840	12,080	1,760	2,400	40,080
Regional total	93	28,040	13,360	2,720	2,400	46,520

[1] Areas include damage on lands of all ownerships.

Table 6.--Mountain pine beetle infestations during 1960 (Cont'd.)

Administrative area 1/	Infestation centers	Intensity of infestation: Light	Moderate	Heavy	Very Heavy	All intensities
	Number	Acres				
PONDEROSA PINE						
Washington:						
Colville Indian Reserv.	1	320	0	0	0	320
Gifford Pinchot Natl. Forest	3	1,440	0	0	0	1,440
Kaniksu Natl. Forest	2	200	0	0	0	200
N. E. Washington	8	400	0	0	0	400
Snoqualmie Natl. Forest	5	200	0	0	0	200
Umatilla Natl. Forest (Wash.)	1	640	0	0	0	640
Wenatchee Natl. Forest	3	1,360	0	0	0	1,360
Yakima Indian Reserv.	3	180	0	0	0	180
Washington areas	26	4,740	0	0	0	4,740
Oregon:						
Deschutes Natl. Forest	5	2,560	0	0	0	2,560
Fremont Natl. Forest	23	1,920	2,840	320	0	5,080
Malheur Natl. Forest	8	1,160	80	0	0	1,240
Mt. Hood Natl. Forest	1	0	0	280	0	280
Ochoco Natl. Forest	1	200	0	0	0	200
Rogue River Natl. Forest	1	0	320	0	0	320
Umatilla Natl. Forest (Ore.)	2	320	0	0	0	320
Wallowa-Whitman Natl. Forest	15	3,360	960	0	0	4,320
Warm Springs Indian Reserv.	1	0	240	0	0	240
Oregon areas	57	9,520	4,440	600	0	14,560
Regional total	81	14,260	4,440	600	0	19,300

1/ Areas include damage on lands of all ownerships.

Table 6.--Mountain pine beetle infestations during 1960 (Cont'd.)

Administrative area [1]	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
WHITE PINE						
Washington:						
Chelan Natl. Forest	28	5,120	1,440	0	0	6,560
Colville Natl. Forest	1	40	0	0	0	40
Gifford Pinchot Natl. Forest	74	36,880	34,400	27,280	11,360	109,920
Kaniksu Natl. Forest	2	240	0	0	0	240
Mt. Baker Natl. Forest	31	3,960	2,080	0	0	6,040
Mt. Rainier Natl. Park	6	920	0	0	0	920
Olympic Natl. Forest	33	5,520	480	0	0	6,000
Olympic Natl. Park	41	10,640	8,800	0	0	19,440
Quinault Indian Reserv.	4	1,760	1,600	0	0	3,360
Snoqualmie Natl. Forest	33	5,480	8,320	480	0	14,280
Wenatchee Natl. Forest	85	17,560	19,440	4,320	1,280	42,600
Washington areas	338	88,120	76,560	32,080	12,640	209,400
Oregon:						
Mt. Hood Natl. Forest	39	6,200	2,400	3,120	0	11,720
Umpqua Natl. Forest	4	720	0	0	0	720
Willamette Natl. Forest	48	10,680	5,040	2,880	0	18,600
Oregon areas	91	17,600	7,440	6,000	0	31,040
Regional total	429	105,720	84,000	38,080	12,640	240,440

[1] Areas include damage on lands of all ownerships.

Table 6.--Mountain pine beetle infestations during 1960 (Cont'd.)

Administrative area 1/	Infestation centers	Intensity of infestation: Light	Moderate	Heavy	Very heavy	All intensities
	Number	Acres				
SUGAR PINE						
Oregon:						
Deschutes Natl. Forest	1	0	320	0	0	320
Rogue River Natl. Forest	2	120	0	0	0	120
Umpqua Natl. Forest	1	40	0	0	0	40
Oregon areas	4	160	320	0	0	480

1/ Areas include damage on lands of all ownerships.

DOUGLAS-FIR BEETLE
Dendroctonus pseudotsugae Hopk.

The total acreage of Douglas-fir beetle infestations decreased (table 7). The extent and intensity of these outbreaks varied locally, increasing considerably in Washington and decreasing in Oregon (table 8). New and aggressive outbreaks are developing on the Umatilla and Okanogan National Forests and on the Colville Indian Reservation in Washington. In these areas the drought of the last several years may be partly responsible for the increased mortality. Salvage operations in southwestern Washington removed considerable quantities of the extensive 1958-59 blowdown material. However, much of the blowdown, which could not be salvaged because of its inaccessibility, produced broods that attacked green trees in the spring of 1960. The amount of this tree mortality that resulted is not known because the trees had not faded sufficiently to be detected during the 1960 aerial survey. Salvage of the currently infested trees before the beetles emerge next spring will aid in holding future losses to a minimum.

The recent outbreak in southern Oregon has subsided, with only a few remaining centers of infestation around Oregon Caves National Monument. On these areas of declining populations, very little further control benefit will be obtained from logging. Salvage should be planned on the basis of timber values to be recovered.

Table 7.--Trend of Douglas-fir beetle infestations in Oregon and Washington, 1957-60

(In acres)

Year of detection	Area of epidemic infestations		Regional total
	Oregon	Washington	
1957	10,880	7,520	18,400
1958	880,160	51,320	931,480
1959	292,520	32,320	324,840
1960	114,160	104,440	218,600

Table 8.--Extent of Douglas-fir beetle infestations in Oregon and Washington in 1960 by administrative area and intensity of infestation

Administrative area [1]	Infestation centers	Intensity of infestation: Light	Moderate	Heavy	Very heavy	All intensities
	Number	Acres				
Oregon:						
Umatilla Natl. Forest (Ore.)	79	23,120	3,200	0	0	26,320
Wallowa-Whitman Natl. Forest	97	15,720	9,520	0	0	25,240
Rogue River Natl.Forest	88	14,320	2,760	160	0	17,240
Umpqua Natl. Forest	60	10,440	960	0	0	11,400
Malheur Natl. Forest	48	6,480	1,640	0	0	8,120
Ochoco Natl. Forest	22	7,600	0	0	0	7,600
Siskiyou Natl. Forest	44	5,920	1,280	0	0	7,200
Siuslaw Natl. Forest	40	4,400	0	0	0	4,400
Umatilla Indian Reserv.	10	2,640	480	0	0	3,120
Willamette Natl. Forest	10	1,360	480	0	0	1,840
Mt. Hood Natl. Forest	7	1,120	200	0	0	1,320
Klamath Indian Reserv.	2	200	0	0	0	200
N.W. Oregon	1	160	0	0	0	160
Oregon areas	508	93,480	20,520	160	0	114,160
Washington:						
Okanogan Natl. Forest	55	18,960	13,440	7,680	1,920	42,000
Colville Indian Reserv.	43	12,040	5,600	1,440	0	19,080
Umatilla Natl. Forest (Wash.)	25	8,920	7,040	0	0	15,960
Wenatchee Natl. Forest	44	10,520	3,200	0	0	13,720
Colville Natl. Forest	24	2,960	1,280	0	0	4,240
Gifford Pinchot Natl. Forest	12	4,040	0	0	0	4,040
Snoqualmie Natl. Forest	11	1,520	0	0	0	1,520
Yakima Indian Reserv.	1	960	0	0	0	960
N.E. Washington	6	920	0	0	0	920
Kaniksu Natl. Forest	10	720	80	0	0	800
Olympic Natl. Forest	4	640	0	0	0	640
Spokane Indian Reserv.	5	320	0	0	0	320
S.W. Washington	2	200	0	0	0	200
Sedro Woolley Dist.	1	40	0	0	0	40
Washington areas	243	62,760	30,640	9,120	1,920	104,440

[1] Areas include damage on lands of all ownerships.

WESTERN PINE BEETLE

Dendroctonus brevicomis Lec.

The trend of the western pine beetle was variable, increasing sharply in Oregon and decreasing in Washington (table 9).

In Oregon the increase was most noticeable on the Fremont, Malheur, and Ochoco National Forests. On these forests, larger and more numerous group killings, indicative of an increasing epidemic, were evident. Elsewhere in Oregon the majority of trees killed occurred singly and as widely scattered small groups. Western pine beetles did not invade trees scorched or killed by the large fires of 1959 in epidemic numbers. Prompt salvage of the dead and scorched green trees reduced the potential threat to the green stand.

In Washington, the recent outbreak on the Yakima Indian Reservation subsided but a few active centers of infestation remain. Elsewhere in Washington less agressive outbreaks occurred on the Umatilla, Okanogan, and Snoqualmie National Forests.

More of the large centers of infestation, particularly those on national forests, were covered by sanitation-salvage logging operations in 1960. In 1961 the most pressing need for control measures will be in Oregon on the Ochoco, Malheur, and Fremont National Forests. On these areas intensified sanitation-salvage logging programs will do much to hold the timber losses to a minimum.

Table 9.--Trend of western pine beetle infestations in Oregon and Washington, 1957-60

(In acres)

Year of detection	Area of epidemic infestations		Regional total
	Oregon	Washington	
1957	39,040	2,720	41,760
1958	96,640	56,080	152,720
1959	106,000	188,300	294,300
1960	142,520	18,300	160,820

OREGON PINE IPS

Ips oregoni (Eichh.)

Oregon pine ips outbreaks reached a peak last year and are now declining on most areas (table 10). The largest remaining outbreaks are on the Umatilla and Wallowa-Whitman National Forests in Oregon. Elsewhere in the region, outbreaks varied considerably in extent and intensity.

Tree killing by this insect around the edges of last season's large fires was very limited. Evidently the heavily scorched trees did not produce large broods of Oregon pine ips adults. Elsewhere, much of the damage caused by this beetle can be minimized by timing thinning and pruning operations from late August until January.

Table 10.--Trend of Oregon pine ips infestations in Oregon and Washington, 1957-60

(In acres)

Year of detection	Area of epidemic infestations: Oregon	Area of epidemic infestations: Washington	Regional total
1957	26,880	1,760	28,640
1958	7,680	3,320	11,000
1959	37,440	25,800	63,240
1960	38,160	3,360	41,520

FIR ENGRAVER

Scolytus ventralis Lec.

For the fourth successive year the total acreage of fir engraver outbreaks increased slightly (table 11). The heaviest mortality occurred in low-value stands of subalpine fir and white fir on the Umatilla and Wenatchee National Forests in Washington, and on the Wallowa-Whitman, Umatilla, Rogue River, Fremont, and Ochoco National Forests in Oregon. No practical control measures have been developed.

Table 11.--Trend of fir engraver infestations in Oregon and Washington, 1957-60

(In acres)

Year of detection	Area of epidemic infestations		Regional total
	Oregon	Washington	
1957	9,920	11,360	21,280
1958	11,120	10,880	22,000
1959	15,520	18,640	34,160
1960	27,240	14,680	41,920

ENGELMANN SPRUCE BEETLE
Dendroctonus engelmanni Hopk.

Tree mortality resulting from attacks of the Engelmann spruce beetle was lower than last year (table 12). The majority of the outbreaks were on the Okanogan and Wenatchee National Forests in Washington and the Wallowa-Whitman National Forests in Oregon. In general the timber is of such a limited amount and low value that control is not warranted.

Table 12.--Trend of Engelmann spruce beetle infestations in Oregon and Washington, 1957-60

(In acres)

Year of detection	Area of epidemic infestations		Regional total
	Oregon	Washington	
1957	24,480	7,680	32,160
1958	4,640	3,840	8,480
1959	4,800	3,520	8,320
1960	1,840	3,120	4,960

SILVER FIR BEETLES
Pseudohylesinus spp.

The acreage infested by these insects declined abruptly this year (table 13). Most of the active infestations are on the Mount Baker and Snoqualmie National Forests in Washington, with the largest concentrations of damaged timber in the upper Baker River and Foss River drainages. Salvage of the currently infested trees and prompt salvage of dead timber is still the only known way to reduce losses caused by these beetles.

Table 13.--Trend of silver fir beetle infestations in western Oregon and western Washington, 1957-60

(In acres)

Year of detection	Area of epidemic infestations: Western Oregon	Western Washington	Regional total
1957	0	1,120	1,120
1958	0	4,720	4,720
1959	320	32,800	33,120
1960	0	3,120	3,120

SEED AND CONE INSECTS

The interest in insects attacking seed and cones is increasing as more seed orchards are established in the region.

The Douglas-fir seed crop was rather sparse in 1960, and the few seeds that were produced were heavily infested by the Douglas-fir cone midge, *Contarinia oregonensis* Foote, and the Douglas-fir cone moth, *Barbara colfaxiana* Kearf..

Very limited observations indicate that insect activity in ponderosa pine cones and seeds was slightly lower this year. Again, the insect involved was the pine cone moth, *Laspeyresia piperana* (Kearf.).

NURSERY AND REGENERATION INSECTS

TEN-LINED JUNE BEETLE
Polyphylla decemlineata (Say)

As regeneration programs are stepped up, more consideration will be given to insects damaging nursery and plantation trees. Current damage to Christmas trees at two plantations near Olympia and Yelm, Wash., appeared to be slackening despite the presence of numerous grubs. It has not been determined whether control is necessary.

PINE RESIN MIDGE
Retinodiplosis sp.

Subepidemic twig killing was caused by this insect at widely scattered locations this year. A long standing infestation in a plantation near Glenwood, Wash., continued. Many trees have been deformed and show retarded growth, but so far few trees have been killed. Control has not been considered necessary.

SITKA-SPRUCE WEEVIL
Pissodes sitchensis Hopk.

General observations this year indicate that light weeviling of leaders of Sitka spruce was quite widely distributed throughout the coastal spruce stands of the region.

OTHER FOREST PROBLEMS

Dying hemlock

The acreage of western hemlock dying from unknown causes decreased from that mapped last year (table 14). The heaviest centers of damage in Washington were on and near the Mount Baker National Forest. Less extensive damage was recorded on the Olympic and Snoqualmie National Forests and in Olympic National Park and southwest Washington. In Oregon, mature hemlock stands in northwest Oregon and on the Siuslaw National Forest sustained the majority of the losses.

Table 14.--Trend of dying western hemlock in western Oregon and western Washington, 1957-60

(In acres)

Year of detection	Area of damage: Western Oregon	Western Washington	Regional total
1957	640	245,760	246,400
1958	0	46,400	46,400
1959	6,240	138,880	145,120
1960	2,000	33,120	35,120

Bear damage

The extent of bear damage to young Douglas-fir and western hemlock stands decreased sharply in western Oregon and increased slightly in western Washington (table 15). The bulk of the tree killing occurred in already understocked stands on and adjacent to the Olympic National Forest in Washington and on and near the Willamette National Forest in Oregon.

Table 15.--Trend of bear damage in western Oregon and western Washington, 1957-60

(In acres)

Year of detection	Area of damage: Western Oregon	Western Washington	Regional total
1957	101,920	103,040	204,960
1958	54,700	118,500	173,200
1959	102,160	17,920	120,080
1960	33,720	18,980	52,700

APPENDIX

Organization and Conduct of the Aerial Survey

This year the Station took over survey responsibility for the northeastern counties in Washington formerly serviced by the Intermountain Forest and Range Experiment Station at Ogden, Utah. 3/

The aerial phase of the regional survey was made by Oregon State Board of Forestry, Washington State Department of Natural Resources, Weyerhaeuser Company, and the Pacific Northwest Forest and Range Experiment Station. Flying time this year totaled 199.1 hours (table 16). All survey flights were made between June 20 and July 27.

Table 16.--Cooperative aerial survey activities in 1960

Area covered	Timbered area surveyed	Survey time		
		Mapping	Ferrying	Total
	M acres		Hours	
Western Oregon	14,815	46.5	3.8	50.3
Eastern Oregon	12,492	58.1	3.7	61.8
Western Washington	13,069	39.1	.8	39.9
Eastern Washington	11,660	44.6	2.5	47.1
All areas	52,036	188.3	10.8	199.1

3/ Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

Table 17.--Extent of epidemic infestations in Oregon in 1960, by forest area, insect species, and intensity of infestation

Administrative area and damage involved 1/	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Deschutes Natl. Forest and adjacent forest lands:						
Western pine beetle	18	10,880	2,080	0	0	12,960
Mountain pine beetle (L)	12	3,040	480	0	0	3,520
Mountain pine beetle (P)	5	2,560	0	0	0	2,560
Mountain pine beetle (S)	1	0	320	0	0	320
Oregon pine ips	12	840	1,920	0	0	2,760
Balsam woolly aphid	2	1,280	0	0	0	1,280
All insects	50	18,600	4,800	0	0	23,400
Fremont Natl. Forest and adjacent forest lands:						
Spruce budworm	27	153,040	56,800	5,920	0	215,760
Ponderosa pine needle miner	8	40,880	11,680	0	0	52,560
Mountain pine beetle (L)	22	10,040	6,400	1,440	2,240	20,120
Mountain pine beetle (P)	23	1,920	2,840	320	0	5,080
Western pine beetle	39	18,800	5,040	0	0	23,840
Oregon pine ips	31	2,280	320	320	0	2,920
Fir engraver	14	2,080	880	0	0	2,960
All insects	164	229,040	83,960	8,000	2,240	323,240

See footnote at end of table.

Table 17.--Extent of epidemic infestations in Oregon in 1960 ... (Continued)

Administrative area and damage involved 1/	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Malheur Natl. Forest and adjacent forest lands:						
Western pine beetle	66	40,960	4,480	0	0	45,440
Douglas-fir beetle	48	6,480	1,640	0	0	8,120
Oregon pine ips	53	3,600	960	0	0	4,560
Mountain pine beetle (P)	8	1,160	80	0	0	1,240
Mountain pine beetle (L)	3	40	400	0	0	440
All insects	178	52,240	7,560	0	0	59,800
Mt. Hood Natl. Forest and adjacent forest lands:						
Mountain pine beetle (W)	39	6,200	2,400	3,120	0	11,720
Mountain pine beetle (P)	1	0	0	280	0	280
Western pine beetle	11	1,520	440	0	0	1,960
Fir engraver	6	1,400	0	0	0	1,400
Douglas-fir beetle	7	1,120	200	0	0	1,320
Oregon pine ips	10	120	360	320	0	800
Balsam woolly aphid	2	2,640	0	0	0	2,640
Pine needle scale	1	0	320	0	0	320
Black-headed budworm	1	440	0	0	0	440
All insects	78	13,440	3,720	3,720	0	20,880
Bear	4	2,040	960	0	0	3,000
All damage	82	15,480	4,680	3,720	0	23,880

See footnote at end of table.

Table 17.--Extent of epidemic infestations in Oregon in 1960 ... (Continued)

Administrative area and damage involved [1]	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Ochoco Natl. Forest and adjacent forest lands:						
Western pine beetle	44	23,280	7,200	0	0	30,480
Douglas-fir beetle	22	7,600	0	0	0	7,600
Fir engraver	6	1,200	1,240	0	0	2,440
Oregon pine ips	24	1,320	640	0	0	1,960
Mountain pine beetle (P)	1	200	0	0	0	200
All insects	97	33,600	9,080	0	0	42,680
Rogue River Natl. Forest and adjacent forest lands:						
Douglas-fir beetle	88	14,320	2,760	160	0	17,240
Fir engraver	23	2,840	1,680	0	0	4,520
Western pine beetle	40	4,280	40	0	0	4,320
Oregon pine ips	29	800	2,400	80	0	3,280
Mountain pine beetle (L)	8	2,080	480	320	0	2,880
Mountain pine beetle (P)	1	0	320	0	0	320
Mountain pine beetle (S)	2	120	0	0	0	120
All insects	191	24,440	7,680	560	0	32,680

See footnote at end of table.

Table 17.--Extent of epidemic infestations in Oregon in 1960 ... (Continued)

Administrative area and damage involved 1/	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Siskiyou Natl. Forest and adjacent forest lands:						
Douglas-fir beetle	44	5,920	1,280	0	0	7,200
Oregon pine ips	1	40	0	0	0	40
Western pine beetle	1	40	0	0	0	40
All insects	46	6,000	1,280	0	0	7,280
Siuslaw Natl. Forest and adjacent forest lands:						
Douglas-fir beetle	40	4,400	0	0	0	4,400
Oak looper	1	0	0	0	2,080	2,080
Balsam woolly aphid	1	280	0	0	0	280
All insects	42	4,680	0	0	2,080	6,760
Bear	17	5,000	2,680	0	0	7,680
Dying hemlock	2	0	1,320	0	0	1,320
All damage	19	5,000	4,000	0	0	9,000

See footnote at end of table.

Table 17.--Extent of epidemic infestations in Oregon in 1960 ... (Continued)

Administrative area and damage involved 1/	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Umatilla Natl. Forest and adjacent forest lands: (Oregon Unit)						
Douglas-fir beetle	79	23,120	3,200	0	0	26,320
Oregon pine ips	38	4,000	4,520	1,280	0	9,800
Western pine beetle	23	5,760	200	0	0	5,960
Fir engraver	14	3,520	2,440	0	0	5,960
Mountain pine beetle (P)	2	320	0	0	0	320
Mountain pine beetle (L)	1	240	0	0	0	240
All insects	157	36,960	10,360	1,280	0	48,600
Umpqua Natl. Forest and adjacent forest lands:						
Douglas-fir beetle	60	10,440	960	0	0	11,400
Fir engraver	6	920	160	0	0	1,080
Mountain pine beetle (W)	4	720	0	0	0	720
Mountain pine beetle (S)	1	40	0	0	0	40
Western pine beetle	2	200	0	0	0	200
Balsam woolly aphid	4	320	800	320	0	1,440
All insects	77	12,640	1,920	320	0	14,880

See footnote at end of table.

Table 17.--Extent of epidemic infestations in Oregon in 1960 ... (Continued)

Administrative area and damage involved 1/	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Wallowa-Whitman Natl. Forest and adjacent forest lands:						
Spruce budworm	15	48,320	480	0	0	48,800
Douglas-fir beetle	97	15,720	9,520	0	0	25,240
Oregon pine ips	44	3,320	5,240	3,080	0	11,640
Fir engraver	15	2,400	1,120	3,200	0	6,720
Mountain pine beetle (P)	15	3,360	960	0	0	4,320
Mountain pine beetle (L)	1	40	0	0	0	40
Western pine beetle	17	2,960	480	0	0	3,440
Engelmann spruce beetle	4	1,120	400	0	0	1,520
	208	77,240	18,200	6,280	0	101,720
Little Lookout Mtn.(Bureau of Land Management)						
Fir engraver	3	120	0	0	1,160	1,280
All insects	211	77,360	18,200	6,280	1,160	103,000

See footnote at end of table.

Table 17.--Extent of epidemic infestations in Oregon in 1960 ... (Continued)

Administrative area and damage involved 1/	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Willamette Natl. Forest and adjacent forest lands:						
Balsam woolly aphid	34	48,320	7,040	5,440	0	60,800
Mountain pine beetle (W)	48	10,680	5,040	2,880	0	18,600
Douglas-fir beetle	10	1,360	480		0	1,840
Fir engraver	1	640	0	0	0	640
Engelmann spruce beetle	1	320	0	0	0	320
All insects	94	61,320	12,560	8,320	0	82,200
Bear	19	6,200	9,280	0	0	15,480
All damage	113	67,520	21,840	8,320	0	97,680
Crater Lake Natl. Park						
Mountain pine beetle (L)	5	3,000	0	0	0	3,000
Western pine beetle	1	40	0	0	0	40
All insects	6	3,040	0	0	0	3,040

See footnote at end of table.

Table 17.--Extent of epidemic infestations in Oregon in 1960 ... (Continued)

Administrative area and damage involved [1/]	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Klamath Indian Reserv. and adjacent forest lands:						
Western pine beetle	9	1,240	0	0	0	1,240
Mountain pine beetle (L)	16	5,360	4,320	0	160	9,840
Oregon pine ips	3	200	0	0	0	200
Fir engraver	2	240	0	0	0	240
Douglas-fir beetle	2	200	0	0	0	200
All insects	32	7,240	4,320	0	160	11,720
Umatilla Indian Reserv.						
Douglas-fir beetle	10	2,640	480	0	0	3,120
Warm Springs Indian Reserv.						
Western pine beetle	18	9,800	2,800	0	0	12,600
Mountain pine beetle (P)	1	0	240	0	0	240
Oregon pine ips	4	160	40	0	0	200
All insects	23	9,960	3,080	0	0	13,040

See footnote at end of table.

Table 17.--Extent of epidemic infestations in Oregon in 1960 ... (Continued)

Administrative area and damage involved [1]	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Northwest Oregon (Oregon State Board of Forestry)						
Douglas-fir beetle	1	160	0	0	0	160
Bear	14	7,560	0	0	0	7,560
Dying hemlock	3	200	480	0	0	680
All damage	18	7,920	480	0	0	8,400

[1] Mountain pine beetle damage has been separated by tree species attacked: L, lodgepole pine; W, western white pine; P, ponderosa pine; S, sugar pine.

Table 18.--Extent of epidemic infestations in Washington in 1960; by forest area, insect species, and intensity of infestation

Administrative area and damage involved 1/	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Colville Natl. Forest and adjacent forest lands:						
Douglas-fir beetle	24	2,960	1,280	0	0	4,240
Mountain pine beetle (L)	10	2,000	320	480	0	2,800
Mountain pine beetle (W)	1	40	0	0	0	40
Fir engraver	4	400	0	0	0	400
Oregon pine ips	3	120	0	0	0	120
Western pine beetle	1	640	0	0	0	640
All insects	43	5,520	2,240	480	0	8,240
Gifford Pinchot Natl. Forest and adjacent forest lands:						
Mountain pine beetle (W)	74	36,880	34,400	27,280	11,360	109,920
Mountain pine beetle (P)	3	1,440	0	0	0	1,440
Douglas-fir beetle	12	4,040	0	0	0	4,040
Western pine beetle	3	860	0	0	0	860
Fir engraver	4	360	0	0	0	360
Zeiraphera sp.	1	7,360	0	0	0	7,360
Balsam woolly aphid	2	640	0	0	0	640
All insects	99	51,580	34,440	27,280	11,360	124,620
Bear	6	2,260	480	0	0	2,740
All damage	105	53,840	34,880	27,280	11,360	127,360

See footnote at end of table.

Table 18.--Extent of epidemic infestations in Washington in 1960 ... (Continued)

Administrative area and damage involved 1/	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Kaniksu Natl. Forest and adjacent forest lands:						
Douglas-fir beetle	10	720	80	0	0	800
Fir engraver	5	680	0	0	0	680
Mountain pine beetle (W)	2	240	0	0	0	240
Mountain pine beetle (L)	5	160	320	0	0	480
Mountain pine beetle (P)	2	200	0	0	0	200
Oregon pine ips	7	280	0	0	0	280
All insects	31	2,280	400	0	0	2,680
Mt. Baker Natl. Forest and adjacent forest lands:						
Mountain pine beetle (W)	31	3,960	2,080	0	0	6,040
Silver fir beetles	5	2,320	0	0	0	2,320
Zeiraphera sp.	2	960	0	0	0	960
All insects	38	7,240	2,080	0	0	9,320
Dying hemlock	43	17,280	4,800	2,080	0	24,160
All damage	81	24,520	6,880	2,080	0	33,480

See footnote at end of table.

Table 18.--Extent of epidemic infestations in Washington in 1960...(Continued)

Administrative area and damage involved 1/	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Okanogan Natl. Forest and adjacent forest lands:						
Douglas-fir beetle	55	18,960	13,440	7,680	1,920	42,000
Mountain pine beetle (W)	28	5,120	1,440	0	0	6,560
Mountain pine beetle (L)	4	960	0	0	0	960
Western pine beetle	4	1,760	320	0	0	2,080
Engelmann spruce beetle	1	0	1,280	0	0	1,280
Fir engraver	3	320	80	320	0	720
Larch budmoth	1	0	1,760	0	0	1,760
All insects	96	27,120	18,320	8,000	1,920	55,360
Olympic Natl. Forest and adjacent forest lands:						
Mountain pine beetle (W)	33	5,520	480	0	0	6,000
Douglas-fir beetle	4	640	0	0	0	640
All insects	37	6,160	480	0	0	6,640
Bear	30	12,840	960	0	0	13,800
Dying hemlock	9	3,584	0	0	0	3,584
All damage	76	22,584	1,440	0	0	25,464

See footnote at end of table.

Table 18.--Extent of epidemic infestations in Washington in 1960 ... (Continued)

Administrative area and damage involved 1/	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Umatilla Natl. Forest and adjacent forest lands: (Washington Unit)						
Douglas-fir beetle	25	8,920	7,040	0	0	15,960
Fir engraver	7	7,960	560	0	0	8,520
Western pine beetle	1	3,520	0	0	0	3,520
Oregon pine ips	9	560	520	200	0	1,280
Mountain pine beetle (P)	1	640	0	0	0	640
All insects	43	21,600	8,120	200	0	29,920
Snoqualmie Natl. Forest and adjacent forest lands:						
Zeiraphera sp.	12	67,360	0	0	0	67,360
Mountain pine beetle (W)	33	5,480	8,320	480	0	14,280
Mountain pine beetle (P)	5	200	0	0	0	200
Western pine beetle	5	1,520	320	0	0	1,840
Douglas-fir beetle	11	1,520	0	0	0	1,520
Silver fir beetles	2	800	0	0	0	800
Balsam woolly aphid	1	40	0	0	0	40
All insects	69	76,920	8,640	480	0	86,040
Bear	9	1,800	0	0	0	1,800
Dying hemlock	5	1,040	0	0	0	1,040
All damage	83	79,760	8,640	480	0	88,880

See footnote at end of table.

Table 18.--Extent of epidemic infestations in Washington in 1960 ... (Continued)

Administrative area and damage involved 1/	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Wenatchee Natl. Forest and adjacent forest lands:						
Mountain pine beetle (W)	85	18,560	19,440	4,320	1,280	42,600
Mountain pine beetle (P)	3	1,360	0	0	0	1,360
Mountain pine beetle (L)	3	480	640	0	0	1,120
Douglas-fir beetle	44	10,520	3,200	0	0	13,720
Fir engraver	16	2,680	160	0	0	2,840
Engelmann spruce beetle	5	480	240	480	0	1,200
Western pine beetle	4	800	0	0	0	800
Oregon pine ips	2	160	0	800	0	960
Pine budworm	1	320	0	0	0	320
Larch bud moth	1	0	320	0	0	320
All insects	164	34,360	24,000	5,600	1,280	65,240
Mt. Rainier Natl. Park						
Mountain pine beetle (W)	6	920	0	0	0	920
Olympic Natl. Park						
Mountain pine beetle (W)	41	10,640	8,800	0	0	19,440
Fir engraver	5	640	0	0	0	640
All insects	46	11,280	8,800	0	0	20,080
Dying hemlock	3	2,080	0	0	0	2,080
All damage	49	13,360	8,800	0	0	22,160

See footnote at end of table.

Table 18.--Extent of epidemic infestations in Washington in 1960 ... (Continued)

Administrative area and damage involved [1]	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Colville Indian Reserv. and adjacent forest lands:						
Douglas-fir beetle	43	12,040	5,600	1,440	0	19,080
Engelmann spruce beetle	2	640	0	0	0	640
Mountain pine beetle (L)	1	480	0	0	0	480
Mountain pine beetle (P)	1	320	0	0	0	320
Western pine beetle	1	480	0	0	0	480
Oregon pine ips	1	120	0	0	0	120
All insects	49	14,080	5,600	1,440	0	21,120
Quinault Indian Reserv.						
Mountain pine beetle (W)	4	1,760	1,600	0	0	3,360
Bear	1	640	0	0	0	640
All damage	5	2,400	1,600	0	0	4,000
Spokane Indian Reserv.						
Douglas-fir beetle	5	320	0	0	0	320
Mountain pine beetle (L)	1	120	0	0	0	120
Oregon pine ips	1	40	0	0	0	40
All insects	7	480	0	0	0	480

See footnote at end of table.

Table 18.--Extent of epidemic infestations in Washington in 1960 ... (Continued)

Administrative area and damage involved [1/]	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Yakima Indian Reserv. and adjacent forest lands:						
Western pine beetle	9	8,560	0	0	0	8,560
Douglas-fir beetle	1	960	0	0	0	960
Mountain pine beetle (L)	1	0	0	480	0	480
Mountain pine beetle (P)	3	180	0	0	0	180
Oregon pine ips	2	0	440	0	0	440
Fir engraver	3	320	0	0	0	320
Spruce budworm	2	5,760	960	0	0	6,720
Balsam woolly aphid	1	0	80	0	0	80
All insects	22	15,780	1,480	480	0	17,740
Glenwood Dist. (Washington State Dept. of Natural Resources)						
Spruce budworm	1	12,000	2,240	0	0	14,240
Fir engraver	3	200	0	0	0	200
Western pine beetle	1	160	0	0	0	160
All insects	5	12,360	2,240	0	0	14,600

See footnote at end of table.

Table 18.--Extent of epidemic infestations in Washington in 1960 ... (Continued)

Administrative area and damage involved[1/]	Infestation centers	Intensity of infestation: Light	Moderate	Heavy	Very heavy	All intensities
	Number	Acres				
Northeast Washington (Washington State Dept. of Natural Resources):						
Larch sawfly	4	4,000	1,440	0	0	5,440
Larch casebearer	1	1,920	0	0	0	1,920
Douglas-fir beetle	6	920	0	0	0	920
Mountain pine beetle (P)	8	400	0	0	0	400
Oregon pine ips	3	120	0	0	0	120
All insects	22	7,360	1,440	0	0	8,800
Sedro Woolley Dist. (Washington State Dept. of Natural Resources):						
Douglas-fir beetle	1	40	0	0	0	40
Southwest Washington (Washington State Dept. of Natural Resources):						
Lodgepole pine needle miner	1	1,120	0	0	0	1,120
Douglas-fir beetle	2	200	0	0	0	200
All insects	3	1,320	0	0	0	1,320
Dying hemlock	1	0	2,240	0	0	2,240
All damage	4	1,320	2,240	0	0	3,560

[1/] Mountain pine beetle damage has been separated by tree species attacked: L, lodgepole pine; P, ponderosa pine; W, western white pine.

DOMINION OF CANADA
VANCOUVER ISLAND
GEORGIA STRAIT
STRAIT OF JUAN DE FUCA
PACIFIC OCEAN
IDAHO
CALIFORNIA
WASHINGTON
OREGON
Blaine
Sumas
BELLINGHAM
LUMMI IND. RES.
ORCAS IS.
SAN JUAN IS.
Friday Harbor
Victoria
Cape Flattery
MAKAH IND. RES.
OZETTE IND. RES.
QUILLAYUTE IND. RES.
HOH IND. RES.
Port Angeles
Forks
Mt Olympus
Mt Octopus
OLYMPIC NAT'L PARK
Quilcene
Port Townsend
Coupeville
WHIDBEY IS.
CAMANO IS.
Arlington
EVERETT
SNOHOMISH
Sultan
Mt Vernon
SWINOMISH IND. RES.
Concrete
Marblemount
Mt Baker
Glacier
Mt Shuksan
Ross Lake
Tower Mtn
Mt Eldorado
Boston Pk
Sentinel Pk
Gilbert
Stehekin
Star Mtn
Lucerne
Glacier Pk
Pyramid Mtn
Brewster
Twisp
Omak
OKANOGAN
Oroville
Chopaka
Loomis
Tonasket
Republic
Curlew
Laurier
Boundary
Brodie Mtn
Metaline
Kettle Falls
COLVILLE
COLVILLE INDIAN RES.
Inchelium
Nespelem
Mason City
Grand Coulee
Coulee City
Almira
Waterville
Davenport
SPOKANE INDIAN RES.
Springdale
Newport
Mt Spokane
SPOKANE
Cheney
Plaza
Ritzville
Odessa
Sprague
Pullman
Colfax
Garfield
Steptoe Bu
Othello
Washtucna
Palouse
Cornell
Endicott
Colton
Uniontown
Elberton
Tekoa
Rosalia
Oakesdale
Tekoa
Malden
Farmington
Benge
Lamont
Wilbur
Creston
Harrington
Davenport
Reardan
Edwall
Fairfield
Latah
Spangle
Medical Lake
Cheney
Four Lakes
Tyler
Sprague
Ritzville
Lind
Hatton
Washtucna
Othello
Connell
Pasco
Richland
Kahlotus
Mesa
Hooper